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difference between the realism and idealism which Montague and Lovejoy typify.

To a realism of brute things the progress of philosophic reflection involved in the sciences seems to me distinctly hostile. The pre-scientific man lives almost exclusively in a world of impenetrable things. The instruments of analysis which science brings reveal to us something of the relational texture of things, and in the clarified vision things lose their grossness. Hard matter, for instance, loses its isolated self-sufficiency, and becomes a vortex or strain in the universal ether, or a group of electric charges (electrons). To naïve common sense which has not penetrated into things and whose vision is not so refined, these conclusions or suggestions of science must remain disconcerting; and when the things analyzed or dissected are still regarded as "sacred" or taboo, the scientific attitude is also regarded as impious. The realism of hard brute things, therefore, seems to me an outcropping of the pre-scientific Adam within us. Hence, when Professor Montague charges that I am a serpent who would drive the neo-realistic Adam out of his Garden of Eden, I gladly (except for the implied reference to my subtlety) accept the analogy, but contend that the serpent was the best friend that Adam ever had, and one that told the truth. By tasting of the tree of knowledge Adam became not only practically productive and creative, but acquired the other, and I believe higher, attribute of divinity, theoretical knowledge, knowing, like the gods, the *difference* between good and evil.

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PROFESSOR THORNDIKE'S ATTACK ON THE IDEO-MOTOR THEORY

IN a paper printed in *The Psychological Review*,¹ Professor E. L. Thorndike presents a searching criticism of the currently accepted theory of ideo-motor action. That theory is itself so important and my colleague's attack upon it is so impressive, and yet to my mind so unconvincing, that, though a layman in psychology, I venture to offer the following objections to his argument.

Throughout his article Thorndike implies that for the idea of an act to produce the act itself, as stated in the ideo-motor theory, would involve a mysterious influence of *sheer similarity* or *similarity as such*, like that assumed in the practise of sympathetic magic.

¹ March, 1913.

And it is on this alleged analogy between sympathetic magic and the ideo-motor theory that he relies to discredit the latter. He supports his general argument by empirical evidence in the form of answers to a questionnaire, which was designed to show, and which appears to have succeeded in showing, that the theory underlying sympathetic magic and the theory underlying ideo-motor action are regarded by psychologists as differing only in their degree of probability.

I

The extravagance of the results of the questionnaire, as Thorndike interprets them, should have warned him that something was wrong. For they would appear to indicate that at least two members of the American Psychological Association have a sneaking sympathy for the belief of primitive peoples, that by reason of a magical affinity of similars for one another you can the better injure your enemy by first injuring a wax image of him. My criticism of this sensational conclusion is to urge an interpretation of the answers to the questionnaire that is more prosaic and, I think, more plausible than the one accepted by Thorndike.

1. I believe that those psychologists (of whom, if memory serves, the present writer was one) who answered the question as to whether or not the wax image procedure could possess any efficacy had in mind nothing magical or crazy, but only the belief that *rehearsing* an act in advance, with wax images or any other accessories and properties, might conceivably make one more skillful and more determined in performing it.

2. My second criticism of Thorndike's interpretation of the replies to his questionnaire bears less directly upon the immediate point at issue than upon the general procedure to be adopted in the wording of such questions as were submitted. Thorndike argues that the fact that the explicit and detailed formulations of the ideo-motor theory were ranked lower in the order of probable truth than the vaguer and simpler formulations indicates that the more clearly the law was understood the less it was believed. I think that this is a mistaken conclusion, for the following reasons: If I ask you to arrange in the order of their probable truth the propositions—(1) *A* is *B*; (2) *A* is *B* and *C*; (3) *A* is *B* and *C* and *D*, you will put (1) as most probable, (2) as next most probable, and (3) as least probable. And you will make this arrangement on purely formal and *a priori* grounds, regardless both of the meanings assigned to the symbols and of the separate intrinsic probabilities of *B*, *C*, and *D*. For, other things equal, the more complex an event the less its antecedent probability; and the more complex the elements asserted in a proposition the greater the possibility of error and the less the probability

of truth. There is, then, nothing in any way significant or surprising in the fact that the vaguer and more general formulations of the law of ideomotor action were assigned a higher probability than those that were more detailed and explicit. The extent to which that assignment was made is not a measure of the esteem in which the law is held by the members of the American Psychological Association. It gives no information on that topic at all. In so far as it is a measure of anything it is a measure only of the general intelligence of those who answered the questions. *From all of which it follows that it should be regarded as an axiom of procedure in drawing up questionnaires of this type that the various propositions submitted for serial arrangement have the same degree of logical complexity.*

II

Let us now turn from the empirical evidence of the questionnaire to the general arguments made by Thorndike against the theory of ideomotor action.

1. The author's main assumption that ideomotor action implies a mystical influence of sheer similarity analogous to that which is supposed to operate in primitive magic appears wholly unwarranted. For when the idea of an act produces the act, we have but a special case of a type of process which is general throughout nature. All effects are in some degree similar to their causes. And in many cases both in the inorganic and the organic realms the effect repeats the qualities of the cause with great precision. Echoes, reflections, and, above all, the fact of reproduction in every form of living matter, are examples in point. In none of these cases is there any mysterious action of a disembodied principle of similarity. The cause A by transmitting energy through a medium M produces an effect A' . What the qualities constituting the effect A' will be, depends upon the antecedent qualities of the cause A and also upon the medium M . In brief, $A' = f(A, M)$. If M were perfectly transparent, or if its distortions corrected one another, A' would be exactly similar to A . And conversely, the extent to which in a given case the effect fails to duplicate the qualities of its cause depends upon the distorting influence of the medium. Now between a given act and the psychocerebral state which we designate the "idea of" that act there is a resemblance. The neural mechanism connecting the two events furnishes a perfectly good medium by means of which the psychocerebral cause can produce its physical effect. Experience seems to show that ideal anticipations of simple bodily movements are as a matter of fact followed by the movements themselves. What is there that is mystical or magical in the situation? As we have already said, the world offers innumerable cases in which effects duplicate

the qualities of their causes. Optical images and photographs; auditory images or echoes, and phonographic records; electrical induction and conduction; and the universal tendency of living cells to reproduce their kind—are each and all illustrations of the reproduction of similars. It would be strange indeed if psycho-cerebral states were the only natural events which were incapable of transmitting any of their qualities or relational patterns to their effects. I do not deny that there is a fundamental puzzle as to the manner in which a conscious state is correlated with its cerebral accompaniment. But granted the fact of correlation there is no *further* puzzle as to why or how the two-sided psycho-physical cause produces by the medium of the motor nerves an effect which resembles it.

2. The relation between the ideo-motor theory and the underlying theory of imitative magic is, as Thorndike says, most instructive, but it is instructive in a sense quite other than that which he supposes. The savage perceives, as we do, that effects resemble their causes in many instances, and particularly in the instance of his own acts and the antecedent ideas of those acts. What he does not perceive is that a *medium of transmission* is always necessary for a cause at one place to reproduce its qualities in the form of an effect at another place. He knows nothing of the air as a medium necessary for the production of echoes or of the ether as a medium for the production of images. And in particular he is innocent of what to us is a commonplace of physiology, viz., the necessity of nerve fibers as the medium necessary for the execution of one's plans or ideas. Given his ignorance of the existence of media of transmission and his resulting belief that all action involves action at a distance, it is not only natural, but well-nigh inevitable, that he should infer that a man can influence his neighbor's body with almost the same ease and by somewhat the same methods as serve to influence his own. Things and thoughts thus seem to him to reproduce their like regardless of spatial distances and material obstacles. His reasoning is the same as that of the superstitious person of to-day who concludes that telepathy is as natural as wireless telegraphy, and who fails to perceive that the specific medium of ether which makes possible the latter is wanting (or unavailable) in the case of the former. Thorndike, as we have said, claims that this reasoning of the savage in support of his sympathetic magic is analogous to the reasoning by which the ideo-motor theory is defended. But I think that, on the contrary, it can easily be shown that the reasoning of the savage is analogous not to that used in defending the ideo-motor theory itself, but rather to Thorndike's own reasoning in refuting it. For the savage appears to argue thus:

If my thought of an action tends to produce that action in my own body it will tend equally to produce its like in all other bodies. [As the ideo-motor theory is observed to be true, sympathetic magic may be inferred to be true.]

While Thorndike appears to argue thus:

If my thought of an action does not tend to produce that action in other bodies it will equally not tend to produce its like in my own body. [As sympathetic magic is observed to be false the ideo-motor theory may be inferred to be false.]

The two arguments when thus condensed into hypothetical propositions are instantly seen to be logically equivalent, the one being the contrapositive of the other. It seems to me, therefore, that my distinguished colleague has fallen rather neatly into the very trap which he set for his enemies. In charging the upholders of the ideo-motor theory with the fallacy of sympathetic magic he has himself committed that fallacy. For, as we have seen, the fallacy underlying sympathetic magic is the assumption that because an idea can produce its like when a physical medium is present, it can do the same when such a medium is absent. Thorndike's fallacy seems to consist in the obverse assumption that because it would be miraculous for an idea to produce its like in the absence of a medium it would be equally miraculous for a reproduction to take place when a medium, such as the nervous system, was present. In each case the crucial difference due to the presence or absence of a medium is overlooked.

III

In the first section of our paper we criticized the interpretation which Professor Thorndike put upon the answers to his questionnaire; and the inductive reasoning by which he sought to establish a damning analogy between sympathetic magic and the ideo-motor theory; in the second section, we endeavored to answer his attempt to demonstrate by deductive analysis the existence of that same analogy; in this third and last section we have to urge a *reductio ad absurdum* to which our author's conclusion would appear to be open, quite apart from the question as to the soundness of his methods of proof.

The denial of ideo-motor action implies a denial of the possibility of imitation and finally of perception itself.

1. The experience of spontaneous and relatively automatic imitation is very familiar. One person smiles and his companions smile back. A cough or a yawn has the same contagious quality. Gestures, accents, and rhythms appear to be imitated spontaneously. Some of these seeming imitations may have originated as accidental variations and have been preserved for their utility by natural selection.

Such might be the explanation of the tendency of a herd of cattle to bellow together or to run away together, when one member of the herd does either of these things. But it would be rather difficult to establish a survival value for contagious yawning and coughing.

The cases of what we may call voluntary imitation are even more difficult to explain without admitting a tendency of perceptions to reproduce their like. The painting of a picture of any objective situation, or the repetition of a sentence seem quite obviously to imply that a perceptual mental state can produce an object representing it. It may be claimed, however, that the responses to separate stimuli which have been either inherited or learned by the trial and error method and become habits would account for these apparent cases of imitation. But such a reply would overlook the essential feature of the situation. For, granted that the elementary responses have individually been learned, it is the collective structure, the *tout ensemble*, or relational order of combination that is important. And this latter feature is often absolutely novel. The only possible cause of the production of the relations in a picture of a scene that is painted for the first time is the relational pattern revealed in the artist's perception of the object to be painted. It does not detract from the essentially creative function of imagination to point out that the sensory material is furnished by memory and that imagination only originates the relational pattern, for it is precisely the latter that is important and distinctive. No more does it explain the imitative reproduction of a complex relational scheme to point out that we have acquired the habit of reproducing the straight lines or the simple tones which may constitute the material elements of the scheme. In short, unless perceptual ideas could reproduce their like, in accordance with the principle asserted in the ideo-motor theory, imitation, both automatic and voluntary, would be impossible.

2. Professor Thorndike does not deny that a group of objects and events outside the organism can and does produce that state of affairs which we call the perception of those objects. And however we may answer the question as to whether or not the "secondary" or non-quantitative qualities of objects exist apart from their relation to the sense-organs, no one denies that ideas or perceptions have a relational similarity or one-to-one correspondence with their causes. *Now any consideration that would make it impossible for a system of ideas to be the cause of a corresponding system of objective acts would make it equally impossible for a system of objects to be the cause of corresponding ideas by which they were perceived.* For the effecting of a movement by a perception and the effecting of a perception by a movement are but the two directions of one and the same kind of causal process. Hence, to reject the possibility of ideo-motor action

logically compels a rejection not only of imitation, but of perception itself.

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AN EXPERIMENTAL STUDY FOR CLASSES IN REASONING AND ITS TRANSFERENCE

FAIRLY ample provisions for experimental approach to the notions of sensations, perceptions, imagery, and even attention already exist, thanks to the experimental psychologist who, from the nature of his science, made these largely analytic conceptions his first concern. The teachers of the science feel the need for enlarging these earlier "tramping-grounds" so as to include such notions as concepts, judgments, recognition, reasoning, and so on, and to place them on an experimental basis. The need of better methods of approach to the explanation and control of the thought processes is self evident from the fact that they constitute the direct and essential mental activities involved in learning, in industrial processes, in social intercourse, and in industrial organization. In this connection it is encouraging to observe that a more than substantial beginning in experimentation on the thought processes has been in progress for the last decade. These experimental contributions have been supplemented by critiques, summaries, and a few extended treatises, all of which should enrich our teaching programme.

Some years ago Spindler¹ rendered timely service to those members of the psychological fraternity who have to teach the fundamental notions of the science to beginners by giving a description of the general attitude he adopted and the methods employed in teaching the concept to his classes. I had hoped that the pen of Professor Spindler or that of some other would furnish a similar description of methods of procedure in presenting working notions of other higher thought processes to elementary classes. My continued hope or wish in the matter is father to the account here submitted for presenting the notion of reasoning by means of experimentation.

Neither apology nor justification for an extended use of experimentation in teaching the laws of mental life seems any longer in order. Reference is made to the matter simply to emphasize the desirability of allowing the means by which psychology has become a science to be used in turn as a method in teaching it.

¹ Spindler, F. N.: "Some Thoughts on the Concept," this JOURNAL, Vol. V., page 684.